The impact of immediate test score reporting on university students' achievement emotions in the context of computer-based multiple-choice exams

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ABSTRACT

Test-taking is an emotion-laden event for many students. Typically, negative emotions are highest at the start of an examination and are replaced by positive emotions as the exam progresses. The impact of computer-based testing and immediate score reporting on students' emotions has not been examined. In Study 1, we evaluated university students' emotions at the end of a computer-based exam and found positive emotions more strongly endorsed than negative. In Study 2, we replicated this finding and used a quasi-experimental pre-post design to examine how emotions changed in response to real examination scores. Exam scores presented immediately had significant positive effects on relief, pride, and hope and negative effects on anxiety and shame even after controlling for the corresponding emotion at the end of the exam. The one exception was anger, which was not impacted by examination score. No interaction effects were found.

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1. Introduction

University represents an emotionally laden achievement context (Pekrun, 2006). In this environment, the evidence convincingly shows that students' emotions can have a sizeable impact on their learning (e.g., Pekrun, Elliot, & Maier, 2009) and that learning environments trigger a wide range of discrete emotions (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Pekrun, Goetz, Titz, & Perry, 2002). This consistent body of research results has lead to the conclusion that emotions are "of critical importance for students' academic learning, achievement, personality development, and health" (Pekrun & Linnenbrink-Garcia, 2012, p. 260). The importance of students' achievement emotions has been established in traditional classroom environments and, more recently, in online and blended-learning environments (Daniels & Stupnisky, 2012). These robust outcomes are important because the context and delivery of university learning is rapidly changing. Computer-based testing and its associated opportunity to provide students with immediate score reporting are two such advancements that may have large implications for students' achievement emotions.

In the present research, we focused on the emotions experienced directly after a multiple-choice computer-based examination (Study 1) and how those emotions were impacted by immediate score reporting, that is, exam scores presented to students within seconds of submitting their exam responses (Study 2). We also investigated if emotions depended on an interaction between emotions at the end of the exam and the actual level of test score. Although some research has evaluated the emotions experienced before, during, and after completing more traditional paper-based examinations (e.g., Pekrun, Goetz, Perry, Kramer, Hochstadt, & Molfenter, 2004), the modern addition of computer-based testing environments and immediate score reporting to students' test taking experiences makes these two conditions important for study. The research presented herein is the first to our knowledge that studies the effects of immediate score reporting in a computer-based testing environment on university students' achievement emotions. We use the control-value theory of emotions to understand the emotional nature of test taking and to guide our review of the evidence between discrete emotions and exam score reporting.

2. Prior research

2.1. Control-value theory of emotions

Pekrun's (2006) control-value theory of emotions outlines a process by which the learning environment gives rise to students'

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cognitive appraisals, which then combine to produce discrete achievement emotions. Once triggered, emotions are considered a proximal predictor of achievement-related behaviour and learning. In addition to specifying antecedents and outcomes associated with achievement emotions, the control-value theory proposes feedback loops allowing for multiple directions of influence on emotions. For example, indicators of performance such as grades, which are often conceptualized as the outcome of emotions, are also theorized to impact students' interpretations of the learning environment, their cognitive appraisals, and their emotions directly. For instance, Pekrun, Hall, Goetz, and Perry (2014) showed that boredom early in the academic year not only negatively predicted test score later in the year, but also that test scores then negatively predicted boredom at subsequent time points. These positive feedback loops repeated across five separate measurements of boredom and test score. In addition to boredom, Pekrun, Lichtenfeld, Marsh, Murayama, and Goetz (2017) found positive feedback loops between academic achievement and six additional discrete emotions (enjoyment, pride, anger, anxiety, shame, and hopelessness) across five waves of the PALMA longitudinal study. Although these are compelling examples of feedback loops, there is also some evidence to the contrary (e.g., Steinmayr, Crede, McElvany, & Wirthwein, 2016). Pekrun acknowledges that feedback loops "can extend over fractions of seconds (e.g., in linkages between appraisals and emotions), days, weeks, months, or years" (2011, p. 36). Most investigations thus far have considered feedback loops over long periods of time. However, because computer-based testing with immediate score reporting allows students to receive their scores within seconds of submitting their responses it is the ideal situation in which to test the only "fractions of seconds" end of the reciprocal effects spectrum.

In addition to specifying linkages, the control-value theory of emotion also offers a classification system for emotions (Pekrun, 2006). Specifically, emotions can be described in terms of valence, activation, and focus (i.e., activity-focused or outcome-focused). Outcome emotions are further linked to the (expectation of) success or failure attached to the learning activity (Pekrun et al., 2002). We selected six outcome emotions: relief, hope, pride, anxiety, anger, and shame. We selected hope and anxiety as representatives of prospective emotions attached to success and failure respectively. We selected pride and shame as representatives of retrospective emotions, again, attached to success and failure respectively. We chose to include relief (retrospective, success) and anger (retrospective, failure) because of their potential relevance to immediate score reporting. Relief is often reported as high at the end of an examination (e.g., Reeve, Bonaccio, & Winford, 2014) because it represents the end of an aversive event. However, relief may dissipate quickly if immediate score reporting reveals unsatisfactory performance rendering the potential benefits of relief lost under conditions of immediate score reporting. For anger, there is some evidence that receiving a less than average test score can trigger anger in students (Lipnevich & Smith, 2009), a situation that may be exacerbated when scores are provided to students immediately and thus is of practical importance. By selecting positive and negative valence emotions linked to either success or failure, we capture a wide range of emotions that may be differentially impacted by objective test scores (Pekrun, 2011, pp. 23–39).

2.2. Examinations

Emotions students experience before, during, and after traditional paper-based examinations have been studied. For example, Reeve et al. (2014) recorded that students endorsed moderate levels of both positive and negative activating emotions before a university-level exam, and higher pride and relief than anger or shame following that exam. Pekrun et al. (2004, Studies 1 and 2) asked German university students to recall the emotions they experienced before, during, and after a paper-based exam and showed that before the examination students reported more negative emotions than positive, with reports of anxiety being highest at this time. Then, during the exam, students started to feel relief, pride, hope, disappointment, or shame depending on how they perceived their performance as progressing. Anxiety decreased during the exam but was reported as often as the other emotions. Finally, after the exam, positive emotions were more strongly endorsed than negative (see also Spangler, Pekrun, Kramer, & Hofmann, 2002). Goetz, Preckel, Pekrun, and Hall (2007) looked at enjoyment, anger, anxiety, and boredom before, twice during, and after an exam as a function of reasoning ability in 6th grade German students. Significant interactions revealed that students with higher reasoning abilities experienced more enjoyment and lower anger and anxiety for the duration of the paper-based exam than those with lower reasoning abilities. More recently, Peterson, Brown, and Jun (2015) used a diary study to track undergraduate students' emotions over the course of a three-week assessment period. They found that positive emotions were endorsed more strongly than negative throughout the entire period but were lowest at the start of the examination.

Taken together, the evidence that is available suggests that the emotional experience of paper-based test taking appears to start with high levels of negative activating emotions like anxiety that drop off as students complete the exam and are replaced by increasing levels of positive activating and deactivating emotions. In other words, at the end of an exam, students appear to report more pleasant emotions than unpleasant and this is likely beneficial for their psychological wellbeing and their future achievement strivings. For example, feelings of hope and pride related to taking exams have been shown to correlate positively with a host of adaptive outcomes including feelings of self-efficacy, perceived control and value, intrinsic motivation, effort, elaboration, rehearsal, and self-regulation (Pekrun et al., 2011). In contrast, anger, anxiety, and shame associated with taking exams are negatively related to many of these same outcomes and positively associated with extrinsic motivation and external regulation (Pekrun et al., 2011). While it is important to understand what researchers have found in traditional testing environments, it is also critical to understand the impact of recent advancements in computer-based testing and scoring on students' achievement emotions because these advancements are quickly becoming the new reality.

2.2.1. Transition to computer-based testing and immediate score reporting

Recent changes in test delivery mark an important paradigm shift for educational testing. Internet-based computerized testing has dramatically changed educational measurement because test administration procedures combined with the growing popularity of digital media and the explosion in internet use have created the foundation for digital assessment. As a result, many educational tests that were once given in a paper format are now administered by computer using the Internet. For many students the days of writing examinations during class time, seated in rows of desks appropriately spaced to discourage cheating, and filling in bubbles on a multiple-choice scan sheet or scribbling written responses in an exam booklet are gone. Now, students regularly complete computer-based exams using learning portals when they feel they are prepared to do so, and blended and online learning make it possible for students to write examinations remotely through secure Internet connections (Beller, 2013). Sireci and Zenisky (2016) recently claimed that computer-based testing has become the